Space Weather Forecast

Issued on Friday, 01 April 2022 at 13:09 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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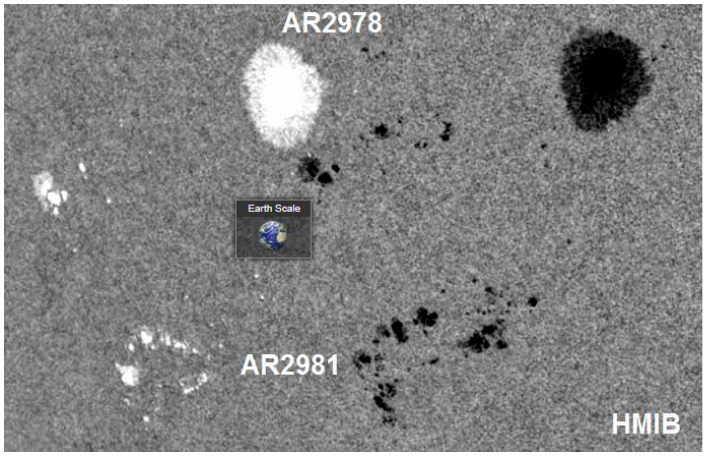
Space Weather Forecast Headline: Risk of Minor/Moderate geomagnetic storms into UTC weekend. Moderate-class X-ray flares and Minor/Moderate Radio blackouts likely throughout, with accompanying slight chance of Minor solar radiation storms.

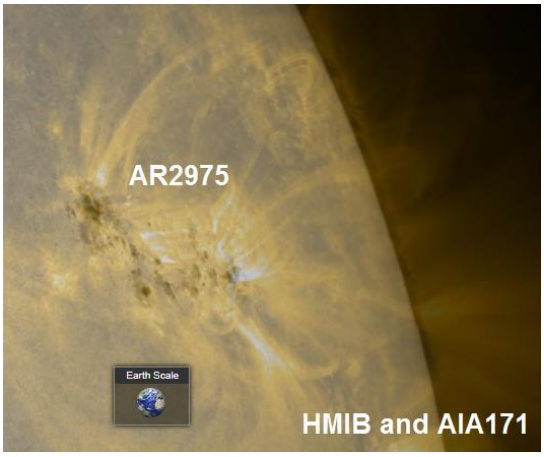
Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been at moderate levels over the past 24 hours, with a large moderate class X-ray flare observed at 31/1835UTC, which originated from the most active sunspot group. X-ray activity was otherwise wholly within the common-class bracket, with frequent mid-ranking flares observed from a mixture of sources - including the large and recently very active group in the northwest, but also increasingly a pair of sunspot regions in the southeast. These groups formed three of six total sunspot regions, including two new small unipolar groups that were designated in the period in the eastern hemisphere.

Foremost amongst the main sunspot regions was that responsible for the moderate-class flare, with this showing an apparent slight decrease in size and fading of its intermediate spots, however this may be in part due to the narrowing viewing angle from a near-Earth viewpoint. There appears to be a latent 'upwelling' in the southeastern part of the sun that is affecting the rapid growth of a pair of sunspot regions here, with rapid growth a precursor to flares in some cases - something to be monitored.

Figure 1: Left: 24-hour magnetic difference imagery of the growing sunspot groups in the southeastern quarter of the sun – compare white sunspot groups (31/1100UTC) with black (01/1100UTC), with the growth of 'AR2981' especially evident. Right: Composite image of 'AR2975' (the sunspot responsible for much of this week's activity) showing detail and a proxy for its emanating magnetic field lines (yellow arcs). Imagery processing courtesy of Helioviewer.





The aforementioned largest flare of the period produced a Coronal Mass Ejection (CME). A

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cursory CME analysis has been conducted and has currently been assessed as a miss ahead of the Earth in the track of its orbit, crossing the radius of Earth's path around the sun around the turn of the UTC day of Monday 04 into Tuesday 05 April. Confirming analysis will be conducted should more imagery become available. An unrelated second CME was visible in imagery in the period, however this has been determined to be far-sided, to no Earth effect.

Finally, there are numerous 'filaments' (arcs of plasma) on the facing side of the sun at present, the largest and most noteworthy of which occupies the south central portion of the sun. Some movement in its trailing portion was observed in the 24 hours, however this is not attributable to any CMEs visible on imagery. Along with other filaments it will be monitored, but particularly in this case given its proximity to any destabilising influence from a nearby growing sunspot.

Solar Wind / Geomagnetic Activity: Earth is currently transiting a sector of space under the influence of a CME, ongoing since 31/0140UTC. This is thought to be one or both of the 28 March CMEs, with the fact that the later emission was travelling faster making it very possible that these features combined into one front. The solar wind is accordingly showing smooth transitions through elevated solar wind measures at present.

The net result of the enhanced solar wind measures was fortuitously limited by the co-aligned orientation of the solar wind magnetic field with Earth's field for much of the period. A provisional Minor Storm G1 interval was seen in the 12-15UTC interval, with activity otherwise below the G-scale.

Energetic Particles / Solar Radiation: Solar radiation has shown a gradual relaxation in the period in the wake of the marginal Minor solar radiation storm S1 from the 30/1737UTC strong-class flare, albeit still remaining slightly above background levels.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be moderate in the four-day period, mainly the result of the recently active large sunspot, but perhaps also increasingly growing spots in the southeast, with a daily Slight Chance of strong-class flares. This risk should lessen very slightly into the new working week as the current most active group leaves the Earth-facing side. Further regions due over the eastern horizon this UTC weekend may counteract this modest fall.

Solar Wind / Geomagnetic Activity: The 28 March CME(s), arrived in the early hours of 31 March, and the result should continue to affect Earth for the remainder of day one (01 April), with the chances of Minor Geomagnetic Storm G1 resurgent as the magnetic field vector becomes increasingly anti-aligned with Earth's field in the coming hours. On day two, Saturday 02 April, a CME from the 30 March strong-class flare may produce a further geomagnetic enhancement around the middle of the UTC day, but confidence is low owing to it being of glancing incidence. Some minor influence is then possible from a pair of 'coronal holes' in the second half of the four-day forecast, but perhaps masked by any preceding CME.

G1/G2 Minor to Moderate Geomagnetic Storms are likely in the first two days of the period, with the risk peaking on day two, Saturday 02 April, gradually tailing off over the remainder of the UTC weekend and into the new working week.

Energetic Particles / Solar Radiation: The continued activity of the largest sunspot in particular gives a daily Slight Chance of further potential enhancements above the S1 Minor Solar Radiation Storm threshold during the period. This will only very gradually decrease, even after the group responsible departs from the front side.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	60	70	30	5
Strong	G3	No	1	10	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	75	75	75	60
Very Active	R3 to R5 X	No	15	15	15	10

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	15	15	15	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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